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EXAMINER	Peter A. Hruskoci
ART GROUP	1797
APPLICANT	Gurunathan Lakshman
SERIAL NO:	10/522,407
FILED	September 9, 2005
FOR	HOG MANURE TREATMENT SYSTEM

Commissioner of Patents
Washington, D.C., 20231
U.S.A.

Dear Sir:

DECLARATION UNDER 37 CFR 1.132

I, Gurunathan Lakshman, of 222-111 Research Drive, Saskatoon, Saskatchewan, Canada solemnly declare that:

1. I am the sole inventor of USSN 10/522,407, filed September 9, 2005 and entitled "Hog Manure Treatment System".

2. My invention relates to a method of treating manure comprising:

a) mixing a quantity of manure with lime such that said mixture has a pH above 11.0 and gases are volatized within said mixture;

b) drawing off gases volatized from said mixture during mixing, thereby producing deodorized and sterilized manure;

c) adding a cationic, anionic or non-ionic flocculating or coagulating polymer to said deodorized and sterilized manure, thereby producing a slurry comprising a floc portion and a liquid portion;

d) separating the floc portion from the liquid portion of the slurry;

e) adding $MgCl_2$, $MgSO_4$, $MgCO_3$, magnesium oxide or a coagulant polymer to said liquid portion, thereby promoting formation of struvite-containing flocs within the liquid portion; and

f) separating the struvite-containing flocs from the liquid portion.

The manure is treated with lime to raise its pH to form a variety of chemical complexes and precipitates which are removed in the solid-liquid separation after the addition of polymer. Raising the pH in the first stage with the high solids content also allows the dissolved mercaptans to promote the coagulation of proteins in the manure.

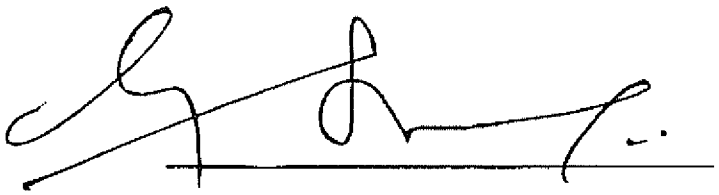
3. The results of treating manure following this process using manure from a hog barn in Manitoba is shown in Table 1. Specifically, raw hog manure was pumped from the barn pits into a 10 m^3 (about 2,300 gallons) storage tank. A sample was taken from the tank for analysis. Lime was added as 20% (200 g/L) $Ca(OH)_2$ solution at a dosage of 6kg/m^3 and was vigorously mixed at about 400 rpm for six hours. The pH of the hydrated lime solution was 12.4. The pH of the mixture after mixing was 11.5. About 100 gallons of this mixture was pumped into a reactor tank and the polymer Superfloc C-496 PG at a prepared solution concentration of 0.25% was added slowly over a period of 3 minutes while the mixture was constantly stirred at 15rpm. The polymer dosage was 4L/m^3. Mixing was continued until large flocs were produced. Mixing was stopped and the flocs were allowed to settle for about 15 minutes. The settled sludge was discharged and the liquid from the top was transferred to next reactor tank. A saturated solution of Magnesium chloride hexahydrate ($MgCl_2.H_2O$) was dosed into the liquid at a dosage of 3kg/m^3. At the same time, the polymer solution of Superfloc C-496PG was dosed into the mixture at a dosage of 2 L/m^3. The entire mixture was stirred at less than 100rpm for about 6 minutes. Additional flocs were produced from the precipitation of struvite and they were allowed to settle and then removed through a screen. The clear liquid from the reactor tank was pumped out into a holding tank and then through an activated carbon filter. A sample was taken from the treated liquid for analysis.

4. For comparison, fresh hog manure samples from the Riverview Hutterite Colony near Saskatoon, Saskatchewan were processed according to US Patent 6,916,426 (Van Slyke). All tests were done by a qualified research technologist under the direct supervision of Dr. G. Lakshman. All tests were conducted at the System Ecotechnologies Inc. lab. Fresh hog manure was obtained in a tightly sealed 25L pail from Riverview Hutterite Colony, near Saskatoon. The sample was taken from the collection pit inside the barn. The sample was well mixed in the pail and a sub-sample of 6.5 L was taken in a glass container.The initial pH of manure was 7.36. A polymer Cytec A-150 solution was prepared as a 0.5% solution in water and used in the tests. Although Van Slyke's

method neither specifies any particular polymer for use nor recommends any dosage for addition, this polymer was chosen as the most logical choice as it is recommended for treating agricultural and municipal wastewaters. The manure sample was stirred using a mechanical mixer at 200 rpm. The polymer was added slowly over a period of 20 minutes to produce flocculation. The polymer was added until large flocs were produced and settling began to occur. Total polymer used was 46.7mg/L. The flocs were allowed to settle and after 45 minutes of settling the liquid had two distinct layers; 4L of turbid layer on top and 2.5L of heavy, dark layer at the bottom. The top layer was decanted from the container and a sub sample of this was sent to the lab for analysis. The pH of the decanted portion was 7.48. The decanted liquid was then added a freshly prepared lime ($Ca(OH)_2$) solution of 20% (200mg/mL) concentration. The pH of lime solution was 12.3. The mixture was constantly stirred at an rpm of 400. The lime solution was added over a period of 30 minutes and the pH rose to 10.83. There were some flocs produced which were allowed to settle. The mixture was carefully decanted and filtered through a screen mesh of less than 100 micron in mesh opening. The filtered sample was sent for analysis, the results of which are shown in Table 2.

5. The data furnished here to compare the results from using Van Slyke's and Lakshman's inventions are from fresh hog manure from hog barns with similar feed rations. However, the concentrations of individual chemical components in the raw manure are greatly influenced by the dilution of the manure from the frequency and extent of barn floor washings. This accounts for the differences in the initial chemical composition of manure in the test results reported here.

6. I declare that all statements made therein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the instant patent application or any patent issuing therefrom.



Gurunathan Lakshman

Table 1. Data from large scale treatment of hog manure using Lakshman's invention in Manitoba

Parameter	Raw Hog Manure	After Treatment	% Removal
Biochemical Oxygen Demand (BOD)	28,900 mg/L	739 mg/L	97.4%
Chemical Oxygen demand (COD)	80,080 mg/L	1,150 mg/L	98.6%
Total Organic Carbon (TOC)	40,560 mg/L	350 mg/L	99.1%
Ammonia Nitrogen	412 mg/L	52 mg/L	87.3
Total Kjeldahl Nitrogen (TKN)	2,813 mg/L	101 mg/L	99.4%
Total Phosphorus (TP)	2,813 mg/L	0.78 mg/L	99.99%
Total Suspended Solids (TSS)	92,800 mg/L	105 mg/L	99.89%
Total Solids (TS)	104,000 mg/L	7,320 mg/L	93%
Specific conductivity	17,900 µS/cm	8,970 µS/cm	50%
E.Coli	115,000,000 ct/g	N/D	~100%

Table 2. Data from the hog manure treatment using Van Slyke's method

Parameter (mg/L)	Raw Manure	After Polymer Treatment		After Lime Treatment	
		Concentration (mg/L)	% Removal	Concentration (mg/L)	%Removal
CHEMICAL PARAMETERS					
Total Ammonia	3,310	3,170	4.2	2,550	22.9
Total Kjeldahl Nitrogen	3,260	2,910	10.7	2,580	20.9
Total Suspended Solids	14,300	4,780	66.6	4,760	66.7
Total Phosphorus	330	190	42.4	36	89.0
Total Potassium	1,800	1,700	5.6	1,600	11.1
Total Sulfur	5,500	3,100	43.6	1,500	72.7
Biochemical Oxygen Demand (BOD)	81,500	10,300	87.4	8,890	89.1
BACTERIAL ANALYSES					
E.Coli	$19X10^6$	$10X10^6$	47.4		
Total Coliforms	$70x10^6$	$20x10^6$	71.4		

The above table shows that the product obtained after Lakshman's treatment is quite different from the product obtained after Van Slyke's treatment method.